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AUTHOR Jamrich, John X.; Dahnke, Harold L.
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ABSTRACT

On the basis of projections of the number of students that the six state institutions of higher education can expect to enroll during the period 1962-1972, analyses of physical facilities were made. Projected enrollments were translated into student credit hours since the need for facilities is related to the volume of instruction. The analyses included an inventory of existing facilities and a space utilization study. An implication of the study is that particular attention should be given to the expansion of facilities for advanced degrees as Ohio seems to lag behind other mid-western states in that respect. (NI)

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**Capital Outlay Needs in the Six State
Supported Institutions of Higher Learning in Ohio
(1962 - 1972)**

A Report Prepared for the Legislative Service Commission
of the Ohio Legislature and the Committee
to Study Government and Finance
Operations

Director:

JOHN X. JAMRICH
Professor of Higher Education
Assistant Dean, College of Education
Michigan State University

Associate Director:

HAROLD L. DAHNKE
Associate Professor
Director of Space Utilization
Michigan State University

Michigan State University
East Lansing, Michigan
March 15, 1963

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MICHIGAN STATE UNIVERSITY EAST LANSING

March 15, 1963

TO: Mr. Roger Cloud,
Speaker, House of Representatives
Mr. Lauren Glosser, Director
Ohio Legislative Service Commission

SUBJECT: Projected Capital Outlay Needs for Ohio's State
Institutions of Higher Education: 1962 - 1972

At your request, and on behalf of the Ohio Legislature, a careful study has been made of the capital outlay needs for instructional facilities in Ohio's state-supported institutions of higher education.

This is a report of the results of the study. The projection of facilities needs is based on careful considerations of enrollments to be provided for by the state institutions. The estimates of gross square footage needs are for facilities including classrooms, teaching laboratories, libraries, office space, research facilities, and replacement. Not included in the estimates are facilities for medical and dental programs, self-liquidating projects such as housing and student services, and elements of the physical plant such as power and light facilities.

The final figures of square footage have taken into account (1) anticipated improvement in the utilization of existing and new facilities, (2) improvement in the extent of library facilities, and (3) a substantial expansion of research facilities for reasons stated in the report.

The dollar estimates of cost are in terms of today's dollar and are based on average cost per square foot for the several types of facilities.

The data used in this report were obtained from the institutions directly and through personal visitations of the campuses. The Director and Associate Director of the study wish to express their sincere appreciation for the excellent cooperation of the several institutions involved.

Sincerely yours,

John X. Jamrich

Harold L. Dahnke

JXJ:sr

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INTRODUCTION

The enterprise of higher education continues to make increasingly significant contributions to the cultural and technological developments of our nation. The recognition of the important role of our colleges and universities is reflected in the level of national concern for providing the human and material resources in order that this potential might be realized. This national concern regarding the future needs of higher education is reflected in similar concerns at state and local levels. The State of Ohio is no exception.

Higher education, public and private, has an impressive history and tradition in the State of Ohio. It is eminently clear that if the youth of Ohio are to have adequate post-high school educational opportunities in the years ahead, plans and commitments must be made now.

The fiscal implications of increasing enrollments and the need for expanding research and service in higher education are compelling reasons for undertaking a study such as this. Continuing concern about these factors has prompted the Ohio Legislature, through its Legislative Service Commission and the Committee to Study Government and Finance and Operations, to authorize this study of future capital outlay needs.

Specifically, the study was authorized in order that the Legislature might obtain information regarding five questions:

1. What is the extent of existing physical plant at the six state-supported institutions of higher education?
2. How efficiently are present instructional facilities being used?
3. How adequate are these facilities?
4. To what extent can improved utilization of instructional facilities meet the growing demands for additional facilities?
5. Taking into account more efficient use of existing plant, what additional facilities will be required during the next decade to provide for research, increased enrollments, and the replacement of obsolete plant?

THE STUDY

The final result of this study is the projection of additional physical facilities which the six state institutions of higher education in Ohio will need in the next decade in order to provide programs of instruction and research for the anticipated levels of student enrollment at Bowling Green State University, Central State College, Kent State University, Miami University, The Ohio State University, and Ohio University. Specifically, the study includes estimates of needs for classrooms, teaching laboratories, offices, library, research space, and replacement of obsolescent space. The study did not concern itself with self-liquidating projects such as residence halls, nor does it include human hospital, medical school, or dental facilities, costs of land acquisition or such elements of the physical facilities complex as power plants.

The process used in determining the facilities needs for the institutions was as follows:

1. A careful analysis was made to determine the number of college-age youth for Ohio in the next decade.
2. On the basis of these figures, and using trend data on the percentage that college enrollments have been of college age, projections were made of the total enrollments in higher education for Ohio between 1962 and 1972.
3. In various proportions, these enrollments will be provided for by (a) private institutions, (b) municipal institutions, and (c) the state institutions. Current trends were used to estimate the percentage of the total enrollment that can be expected to attend the group of six state-controlled institutions of higher education in Ohio. Also, each college and university, public and private, in the state was asked to provide the Director of the study with its own anticipated enrollment levels for the next decade.
4. A complete inventory of the physical plant at the six state-controlled institutions was made. Information was obtained regarding the extent of the facilities, their use, adequacy, quality, cost, and source of building funds. The facilities reported as inadequate or obsolete were then checked personally by the Director and Associate Director of the study. These visits provided an opportunity to become well acquainted with the overall plans, aspirations, and needs of the six state institutions.
5. Finally, a careful analysis was made of the levels of utilization of existing instructional facilities at each of the institutions.

Thus, the combination of needs indicated by increased enrollments and for replacement of obsolete facilities was set side by side with the implications of improved utilization of existing facilities. These analyses form the basis for the projections.

Obviously, the need for facilities is inseparably related to the volume of instruction to be provided. The projected enrollments were, therefore, translated into student credit hours to be taught. In addition to the need for instructional space, careful consideration must be given to the possibility of new programs which may be established and to the research which may or should be provided for in Ohio.

In fact, the data gathered for this study on the number of advanced degrees granted in Ohio would suggest that particular attention should be given to expanding graduate work and the research programs that normally accompany it. The State of Ohio is still far behind in the production of doctorates and master's degrees.

The point to be made is that in addition to the arithmetical computations, some subjective judgments must be made if the future needs are to be met adequately.

HIGHER EDUCATION IN OHIO

This is not a survey of higher education in the State of Ohio. Inevitably, though, consideration of facilities needs must derive from the students to be served and the instructional programs to be provided. Post-high school education in the State of Ohio is provided by more than sixty institutions plus numerous branches of the state colleges and universities. In recent years the question has been raised as to whether the geographical distribution of higher education institutions is adequate. At the present time, there exists enabling legislation for the establishment of community colleges. One such college has been organized in the Cleveland area.

The question which poses itself is whether the post-high school education of the state will be developed by means of community colleges or a further extension of branches of the state and/or private institutions. The answer to this question is, in all probability, not either one or the other. Both types of facilities may have a very legitimate role to play.

The assumption of this study was that during the next decade there would be some community college development resulting in an increase in the number of students cared for by the group of "municipal" institutions, but that the major proportion of the increased enrollments computed in this study would be cared for by the existing colleges either on their campuses or in extension centers. The fact may be that even if community colleges develop more rapidly than is assumed here, their enrollments will be primarily students who would not otherwise have attended or students who intended to pursue technical or non-degree curricula. For the latter there is an increasing need and it should be provided for.

In view of the complexity of the problem, the Legislature might well consider the appointment of a state-wide commission to make some determinations as to the pattern of future development.

DEGREES GRANTED

An important product of instructional programs are the academic degrees earned at the colleges and universities. The relative position of the State of Ohio on this criterion should be a determiner of the attitude taken on facilities needs not only for instruction but also for research, Tables 1, 2, 3, and 4 summarize data on earned degrees at all institutions in the State of Ohio.

Table 1 presents data on earned doctorates for the 1959-60 academic year in Ohio and six other midwestern states. Two bases for comparison are possible. One is the number of doctorates per million population and the other is the percent the doctorates are of the total for the states as compared with the percent that the population of Ohio is of the total for the group.

Ohio had 22.9 percent of the population of these states but produced only 12.1 percent of the doctorates. Ohio produced only 38.2 doctorates per one million population compared with an average of 72.5 for the group and compared with 102.1 for Indiana and 100.8 for Iowa.

Certainly, the state should give concerted attention to increasing the number of earned doctorates in its colleges and universities. This fact has implications for instructional and research facilities needed.

Table 2 presents similar data on earned master's and second-level degrees for the State of Ohio and the six other midwestern states. The situation in this case is not very different from the deficiency identified in the case of the doctorate degrees. Ohio falls far short here, also.

Table 1.
Earned Doctorate Degrees for Ohio and Selected North Central States (1959-1960)

STATE	Number of Doc. Degrees	Percent of Total	Number Per 1,000,000 Population	Population 1960	Percent of Total
Ohio	371	12.1	38.2	9,706,397	22.9
Iowa	273	8.9	100.8	2,757,537	6.5
Illinois	823	26.7	81.6	10,081,158	23.8
Indiana	430	15.6	102.1	4,662,498	11.0
Michigan	512	16.6	65.4	7,823,194	18.5
Minnesota	245	8.0	71.7	3,413,864	8.1
Wisconsin	373	12.1	94.4	3,951,777	9.3
Total for this Group of States	3,077	100.0	72.5	42,396,425	100.0

Table 2.
Earned Master's and Second-Level Degrees for Ohio and Selected
North Central States (1959-60)

STATE	Number of Mas. & 2nd- Level Degrees	Percent of Total	Number Per 1,000,000 Population	Population 1960	Percent of Total
Ohio	2,713	14.8	279.4	9,706,397	22.9
Iowa	987	5.4	357.6	2,757,537	6.5
Illinois	4,436	24.2	440.1	10,081,158	23.8
Indiana	3,038	16.5	651.9	4,662,498	11.0
Michigan	4,565	24.9	583.8	7,823,194	18.5
Minnesota	1,099	6.0	322.3	3,413,864	8.1
Wisconsin	1,526	8.3	386.3	3,951,777	9.3
Total for this Group of States	18,364	100.0	433.1	42,396,425	100.0

The data in Table 3 regarding earned baccalaureate and first-professional degrees for Ohio are somewhat more encouraging. Even so, Ohio is second lowest on the number of earned baccalaureate degrees per one million population.

Table 4 summarizes data on the earned undergraduate and graduate degrees in Ohio by type of institution between 1947 and 1958. During that period, the state institutions produced over 40 percent of the undergraduate degrees, and slightly over 60 percent of the graduate degrees in the state. The lack of recency of data on degrees earned does not provide as useful a trend as do the current enrollment statistics to be discussed later.

Implications

1. The comparatively low ranking of Ohio on doctorates and master's degrees granted suggests that careful attention be given to the provision for graduate instructional and research programs as consideration is given to the provision of funds for physical facilities.
2. The state needs definitive guidelines regarding the pattern of future higher education development in Ohio.

Table 3.
Earned Bachelor's and First-Professional Degrees for Ohio and Selected
North Central States (1959-60)

STATE	Number of Bach. & 1st- Level Degrees	Percent of Total	Number Per 1,000,000 Population	Population 1960	Percent of Total
Ohio	18,957	20.1	1,952.3	9,706,397	22.9
Iowa	7,637	8.1	2,767.0	2,757,537	6.5
Illinois	19,190	20.3	1,903.8	10,081,158	23.8
Indiana	12,117	12.8	2,600.2	4,662,498	11.0
Michigan	17,708	18.7	2,264.5	7,823,194	18.5
Minnesota	9,476	10.0	2,778.9	3,413,864	8.1
Wisconsin	9,438	9.9	2,389.4	3,951,777	9.3
Total for This Group of States	94,523	....	2,229.3	42,396,425	....

Table 4.
Earned Degrees Granted by the Three Types of Institutions in Ohio

Type of Institution	1947-48		1950-51		1955-56		1958-59		TOTAL	
	Bach.	Grad.	Bach.	Grad.	Bach.	Grad.	Bach.	Grad.	Bach.	Grad.
Private	No.	655	9,089	860	6,911	648	8,212	853	30,643	3,026
	%	43.6	46.23	30.21	45.06	27.31	45.76	28.30	45.4	29.9
Municipal	No.	2,088	2,530	257	1,835	233	2,178	328	8,631	993
	%	14.14	12.75	9.37	12.25	10.03	12.14	10.88	12.8	9.8
State	No.	1,067	8,215	1,720	6,231	1,487	7,557	1,833	28,244	6,107
	%	56.39	41.41	60.41	41.60	62.66	42.11	60.82	41.8	60.3
TOTAL	No.	14,765	19,834	2,847	14,977	2,373	17,947	3,014	67,523	10,125

COLLEGE AGE AND COLLEGE ENROLLMENTS

The number of students seeking enrollment in the colleges and universities of Ohio will depend upon (1) the number of college-age youth and (2) the proportion of the college age planning for higher education.

Projections of college-age youth for the next decade are not difficult to make in view of the fact that these young people are actually alive today. The projections, then, need to reflect a survival rate, percentages intending to go on to college, and a consideration of in-and-out-migration.

In this study, college age has been defined as including 18, 19, 20, and 21 year olds. The projections have been made on the basis of survival rates only, with the in-and-out-migration factor being left out completely. If anything, the probability is that for Ohio this would be a plus factor. Thus the estimates of college age may be somewhat conservative.

Table 5 presents the projections of college age made for this study. Between 1962 and 1972 the number of 18-21 year olds will increase from 537,231 to 805,437. It

Table 5.
College-Age Projection for Ohio
(18-21)

AGE	1960	1962	1964	1966	1968	1970	1972
6	210,726						
7	208,590						
8	202,174						
9	191,500						
10	191,312						
11	190,023						
12	195,051						
13	189,308						
14	138,623						
15	137,526						
16	141,812						
17	150,202						
18	131,537	141,515	138,103	194,086	190,658	200,735	208,954
19	114,944	149,859	136,954	188,256	198,754	190,016	206,730
20	112,529	131,214	141,166	137,767	193,606	190,186	200,238
21	116,980	114,643	149,455	136,594	187,760	188,256	189,515
TOTALS	475,990	537,231	555,693	656,703	760,778	769,193	805,437*

* The figures of college-age youth through 1972 were derived by applying mortality rates per 1,000 people to Ohio population figures. All population figures are taken from *United States Census of Population, Ohio, 1960*. Mortality rates used are from *Life Insurance Fact Book — 1962*.

should be noted that the increase is a very uneven one, with a 5.3 percent increase between 1962 and 1964; a 22.2 percent increase between 1962 and 1966; a 41.6 percent increase between 1962 and 1968. The increase between 1962 and 1972 is about 50 percent.

Table 6 is a summary of total enrollments in Ohio from 1940 through 1962, and projections from 1962 through 1972. There are two enrollment estimates shown in the table. One estimate assumes that the percentage that college enrollments are of the college age will remain 37.6 between 1962 and 1972. The other estimate assumes that this percentage will increase by .7 of one percent per year until it is 44.6 percent in 1972.

Table 6.
College Age and College Enrollment Projections for
the State of Ohio, 1964-1972

YEAR	College-Age (18-21 yr. olds)	College Enrollments		Percentage that College Enrollments are of Col. Age	
		Estimate A (1)	Estimate B (2)	Estimate A	Estimate B
1940	496,495	84,367	.....	17.0	....
1950	430,560	124,300	.....	28.9	....
1955	411,770	131,590	.....	31.9	....
1960	475,990	175,139	.....	36.7	....
1962	537,231	202,374	.....	37.6	....
1964	565,693	212,700	220,620	37.6	39.0
1966	656,703	246,920	265,308	37.6	40.4
1968	760,778	286,052	318,005	37.6	41.8
1970	769,193	289,216	332,291	37.6	43.2
1972	805,437	302,844	359,224	37.6	44.6

(1) Assumes that college enrollments will be 37.6% of college age throughout. Enrollments from 1940 to 1962 are actual.
(2) Assumes the percent (that college enrollments are of college age) will increase at an annual rate of .7 of one percent.

It should be noted that since 1940 this percentage has been increasing steadily in Ohio from 17.0 in 1940 to 37.6 in 1962.

On this basis and on the basis of studies indicating a continued increase in the proportion of high school graduates planning to go to college, enrollment projections and facilities projections of this study are based on Estimate B, the higher of the two. Accordingly, the number of college enrollees in Ohio is expected to rise from 202,374 in 1962 to 265,308 in 1966; 318,005 in 1968; and 359,224 in 1972.

ENROLLMENT BY TYPES OF INSTITUTION

A specific determination of facilities needs in the state colleges and universities derives from a consideration of the proportion of total enrollments distributed among the three types of institutions in the past and probable trends in the future. Table 7 is a summary of enrollment trends in the private, municipal, and state institutions of higher education in Ohio between 1940 and 1962. It is worth noting that the private institutional proportion actually decreased from 1950 through 1956 and then began to increase until 1960 when the present trend of decreasing percentage began. The municipal institutions present a rather uneven level throughout while the state institutions have shown an increase for every year in the period.

On the basis of estimates of college-age youth, total college enrollment projections for Ohio, and an analysis of the trends in the proportion of enrollments among the three types of institutions, an enrollment projection was made as part of this study for the group of municipal, private, and state institutions. The results of that projection are presented in Table 8. The data were derived on the assumption that the percentage in private institutions would continue to decline, the percentage in the municipal would increase slightly, and the percentage in the state institutions would increase from its 39.8 in 1962 to 45.0 in 1972.

On this basis, the head count enrollments in the private colleges would increase from 87,071 to 125,728 in the decade; the municipal would increase from 34,720 to 71,844; and the enrollments in the state institutions would increase from 80,583 to 161,650. It should be noted that the projection calls for more than doubling of the enrollments in the state institutions.

Table 7.
Enrollment Trends in Ohio Colleges and Universities: 1940-1962
(Head Count)

Type of Institution	1940	1950	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Private												
No.		60,332	52,333	55,275	59,427	64,085	66,809	71,019	74,805	79,034	82,719	87,071
%	N.A.	43.5	46.2	45.5	45.2	45.1	45.2	45.4	45.5	45.1	44.0	43.0
Municipal												
No.		23,305	21,028	22,431	24,203	25,517	26,057	26,722	27,323	29,073	31,935	34,720
%	N.A.	18.8	18.6	18.5	18.4	18.0	17.6	17.1	16.6	16.6	17.0	17.2
State												
No.		40,663	39,807	43,698	47,960	52,516	55,040	58,644	62,246	67,032	73,362	80,583
%	N.A.	32.7	35.2	36.0	36.5	37.0	37.2	37.5	37.9	38.3	39.0	39.8
TOTALS	84,367	124,300	113,161	121,404	131,590	142,118	147,906	156,385	164,375	175,139	188,016	202,374

N.A. — Not Available

Table 8.
Enrollment Projections Made as Part of This Study for the Ohio Colleges and Universities, Based on College Age and College Enrollment Projections for Ohio

Type of Institution		1964	1966	1968	1970	1972
Private	No.	91,361	104,531	119,251	121,286	125,728
	%	41.2	39.4	37.5	36.5	35.0
Municipal	No.	39,915	49,081	60,420	63,135	71,844
	%	18.0	18.5	19.0	19.0	20.0
State	No.	90,474	111,694	138,332	147,869	161,650
	%	40.8	42.1	43.5	44.5	45.0
TOTAL (Based on Estimate B in Table 6)		220,620	265,306	318,003	332,290	359,222

It may be interesting to compare the projection made as part of this study with those made by the individual institutions in the State of Ohio. Table 9 is a summary of the information submitted by the colleges and universities of the state on the question

Table 9.
Enrollment Levels as Projected By Private, Municipal, and State Colleges and Universities: 1964 - 1972
(Head Count)

YEAR		Private (1)	Municipal (2)	State (3)	Total
1964	No.	88,500	38,995	94,099	221,594
	%	39.9	17.6	42.5	....
1966	No.	90,400	45,163	110,392	245,955
	%	36.7	18.4	44.9	....
1968	No.	98,350	49,715	125,811	273,876
	%	35.9	18.2	45.9	....
1970	No.	101,640	52,416	138,324	292,380
	%	34.7	17.9	47.3	....
1972	No.	105,780	54,600	153,320	313,700
	%	33.7	17.4	48.9	....

(1) The private colleges responding represented 86% of the 1962 fall enrollments in this group of institutions. The projections are adjusted proportionately.

(2) All of the three municipal institutions are included in these statistics.

(3) All of the six state institutions are included in these statistics.

of future enrollments as they have projected them. Comparison of the data of these two tables suggests that the individual institutions are estimating enrollments well below the projections made by this study. In fact, reference to Table 6 shows that the total enrollments made by the institutions for 1970 is even lower than the low Estimate A, which assumed that the percentage that college enrollments are of the college age would remain the same. It is the opinion of the Director of the Study that the institutions have not made very realistic and penetrating analyses of the implications of the number of future 18-21 year olds for their future enrollments.

Implications

1. The number of college-age youth will rise from about 537,000 in 1962 to over 800,000 in 1972.
2. College enrollments for the entire state of Ohio will increase from about 200,000 in 1962 to almost 360,000 in 1972.
3. The proportion of college enrollments in the state institutions will increase from about 40 percent in 1962 to 45.0 in 1972.
4. The number of students enrolled in the state institutions will increase from 80,000 in 1962 to over 160,000 in 1972.
5. The sharpest increases in enrollments will occur in 1966 and 1968.

INVENTORY OF THE PHYSICAL FACILITIES

As part of this study, a detailed inventory of the physical facilities at the six institutions was made. Although the total detail of the inventory is not presented in this report, one of the purposes of the process was to provide for the institutions a relatively uniform procedure and nomenclature so that such an inventory can now be retained on a continuous basis or repeated at some later time with considerably more ease. The terminology and definition utilized were developed in consultation with the several institutional representatives. Among other advantages, the procedure has been developed for use with mechanical data processing equipment.

Information requested regarding the buildings included: the date of construction, type of construction, condition of the building, present use of the building, its suitability, the value of the building as carried on the plant ledger, the source of the funds, its gross volume and square footage.

On another form, detailed information was requested for every room in these buildings. The information included: the type of room, the department to which it was assigned, the functional purpose of the room, the square feet of assignable space within the room, the number of student stations in it, and its rated capacity.

General Summary

Table 10 provides a general summary of the data on gross area of the buildings, their value, and their condition. According to this table, the non-residential buildings in the six state institutions have a gross square footage of 11,284,682. Of this total, 7,361,325 square feet are designated for instruction and research purposes. This is about 65 percent of the total.

The reported value of the buildings, as it is carried on the plant ledgers of the institutions, is \$163,408,000. Of this total, \$99,876,000 is designated for instruction and research, which is about 61 percent of the total reported value.

It may be worth noting that the total gross represents about 140 square feet per student enrolled; the total value represents an average of \$14.50 per square foot. This total value also represents an average of \$2,027 per student currently enrolled.

Present Condition of Buildings

Table 10 also provides a general summary of the reported condition of the buildings in the ten categories of use. A more specific summary of the condition of buildings is shown in Table 11 which presents the data according to condition and for each of the six institutions.

For the total group of six institutions, 984,019 square feet of space, or about 8.7 percent, is reported as "should be razed and will require replacement." Another 15 percent is reported as in need of major renovation. Ohio State, Miami, and Central report the three highest percentages of plant in condition three. Of the total square footage in condition three, Ohio State accounts for almost 80 percent of it. Not all of this space at Ohio State, however, is to be replaced.

Table 10.
Summary of Non-Residential Buildings: Major Use, Area, Value,
and Condition for All State Institutions

Major Use of Building	Gross Area Square Feet	Value	CONDITION		
			Satisfactory	Renovate	Replace
Multipurpose	812,693	\$ 10,618,000	663,089	104,000	45,604
Instruc. and/or Research	7,361,325	99,876,000	5,388,629	1,243,383	729,313
Library	512,926	7,992,000	230,582	282,344	.....
Administration	201,961	3,263,000	198,724	.....	.....
Public Service	851,637	18,888,000	851,637	.....	.....
Internal Services	145,558	283,000	30,417	5,458	109,673
Student Services	862,592	14,104,000	761,542	48,287	52,763
Plant Operations	438,767	7,313,000	380,827	19,247	38,593
Auxiliary Services*	14,960	283,000	14,960	.....	.....
Non-Inst. Services	59,507	788,000	54,771	.....	4,736
TOTALS	11,284,682	\$163,408,000	8,575,178	1,725,485	934,019

* Highway Test has "no use," "no value," is in need of renovation, and is 22,756 Square Feet. This figure is included in the Area Sq. Ft. total and the Renovate total.
 Ellis Hall at Ohio University is not included in this table. Ellis is 40,162 sq. ft., "use" is Instruc. and/or Research, and is in Satisfactory condition.

Table 11.
Present Condition of Non-Residential Facilities

INSTITUTION:		Bowling Green St. Univ.	Central State College	Kent State	Miami Univ.	Ohio State Univ.	Ohio Univ.	TOTALS
Satisfactory Condition	Sq. Ft.	533,465	214,025	1,054,920	704,617	4,705,317	1,362,834	8,575,178
	% of Gross	70.38	67.50	95.69	66.65	70.40	99.74	75.99
Requires Major Renovation	Sq. Ft.	205,561	73,749	.....	253,415	1,192,760	.....	1,725,485
	% of Gross	27.12	23.26	.....	23.98	17.84	.....	15.29
Should Be Razed and Replaced	Sq. Ft.	19,000	29,291	47,540	99,104	785,484	3,600	984,019
	% of Gross	2.50	9.24	4.31	9.37	11.76	.26	8.72
Total Gross	Sq. Ft.	758,026	317,065	1,102,460	1,057,136	6,683,561	1,366,434*	11,284,682*
Total Net	Sq. Ft.(1)	507,877	212,433	738,648	708,281	4,477,985	915,510	7,560,736

* These figures do not include 40,162 sq. ft. of Ellis Hall at Ohio University being renovated in 1962-63.
 (1) 67% of Gross

Table 12.
Summary of Non-Residential Facilities by Date of Construction

DATE OF CONSTRUCTION	INSTITUTION						Total All— Institutions	
	Bowling Green	Central State	Kent	Miami	Ohio State	Ohio Univ.		
1. Prior to 1900:	.....	2,268	13,036	58,695	270,138	85,546	429,683*	% 3.83
2. 1900 through 1924:	192,590	111,337	211,921	301,208	2,424,624	244,568	3,486,248	31.11
3. 1925 through 1950:	387,719	102,502	553,218	251,439	1,506,833	390,439	3,192,150	28.48
4. Since 1950:	177,717	100,958	324,285	445,794	2,404,548	645,881	4,099,183	36.58
TOTAL GROSS SQ. FT.	758,026	317,065	1,102,460	1,057,136	6,683,561* (77,418)	1,366,434	11,207,264*	100.00

* Date of construction was unattainable for 77,418 square feet. The 11,207,264 does not include this amount. It also does not include 40,162 square feet of Ellis Hall at Ohio University being renovated in 1962 - 63.

Date of Construction

Table 12 provides some interesting information on the rate of construction in the six Ohio institutions. Since 1950, 36.58 percent of the square footage was constructed, or a total of 4,099,183 square feet. Since 1950, the enrollments have exactly doubled in these institutions, while the square feet of space has increased by just 58 percent. This would suggest that the institutions have been making increasingly better use of their facilities.

Suitability

The data on suitability of buildings for their present purposes are summarized in Table 13. According to this table, about 8.5 percent of the building space is labeled as "should be replaced."

Total Value and Source of Building Funds

The total value for all buildings was given in a previous table. Table 14 presents an analysis of the total value for each of the six institutions and also summarizes data on the source of the building funds.

According to the data of the table, state appropriated funds have provided about 80 percent of the building funds for existing plant. A little over ten percent have come from local funds; about 3.7 percent have come from federal funds; and about three percent have come from revenue bonds.

Table 13.
Suitability for Present Purpose of Non-Residential Facilities

SUITABILITY	INSTITUTION						TOTALS
	Bowling Green	Central State	Kent	Miami	Ohio State	Ohio Univ.	
ADEQUATE							
Sq. Ft.	515,106	105,240	992,605	460,450	4,532,339	992,506	7,598,246
% of Gross	67.95	33.19	90.03	43.56	67.81	72.63	67.33
FAIR							
Sq. Ft.	61,230	65,379	.....	268,414	865,647	231,626	1,492,296
% of Gross	8.08	20.62	.....	25.39	12.95	16.95	13.23
POOR							
Sq. Ft.	162,690	60,958	62,315	234,192	608,517	104,644	1,233,316
% of Gross	21.46	19.23	5.66	22.16	9.10	7.66	10.93
SHOULD BE REPLACED							
Sq. Ft.	19,000	85,488	47,540	94,080	677,058	37,658	960,824
% of Gross	2.51	26.96	4.31	8.89	10.14	2.76	8.51
TOTALS	758,026	317,065	1,102,460	1,057,136	6,683,561	1,366,434	11,284,682

Table 14.
Total Value and Source of Funds for Non-Residential Buildings

SOURCE	INSTITUTIONS						TOTAL
	Bowling Green	Central	Kent	Miami	Ohio State	Ohio Univ.	
Appropriation:	Amt.	\$ 3,996,000	\$19,911,000	\$13,496,000	\$70,787,000	\$12,947,000	\$131,158,000
	%	93.54	95.72	86.78	82.63	77.89	70.51
Private Funds	Amt.	13,000	.....	.....	642,000	344,000	599,000
	%	.13	.....	.....	3.93	.38	3.26
Revenue Bonds	Amt.	40,000	.....	.....	.....	2,414,000	2,467,000
	%	.38	.....	.....	.....	2.66	13.43
Student Fees	Amt.	5,000	.....	.....	670,000	436,000	76,000
	%	.05	.....	.....	4.11	.48	.42
Federal Funds	Amt.	208,000	100,000	2,735,000	.....	1,993,000	1,087,000
	%	1.94	2.39	11.92	.....	2.19	5.92
Local Funds	Amt.	425,000	79,000	300,000	1,525,000	14,308,000	563,000
	%	3.96	1.89	1.30	9.33	15.74	3.07
Undesignated	Amt.	.....	.....	.....	.....	602,000	624,000
	%	.....	.....	.....	.....	.66	3.39
TOTALS		\$ 4,175,000	\$22,946,000	\$16,333,000	\$90,884,000	\$18,363,000	\$163,413,000

Non-Residential Facilities by Function

The room-by-room inventory of the physical plant provided data on the net usable square feet. The net square footage was also distributed among ten categories of function as shown in Table 15. Of the 7,569,098 square feet reported as net usable, over 4,000,000 square feet were reported for "instruction." This is almost 53 percent. Instruction, research, library, and administration accounted for 5,452,152 square feet or about 72 percent.

Table 15.
Summary of Non-Residential Facilities by Function
(All State Institutions)

FUNCTION	Number of Rooms	Number of Stations	Assignable Square Feet*
1. Instruction	8,971	107,725	4,048,683
2. Research	1,889	3,802	719,361
3. Library	579	10,387	500,611
4. Administration	585	2,448	183,501
5. Public Services	321	6,043	305,608
6. Internal Services	463	905	327,561
7. Student Services	1,115	10,360	667,398
8. Plant Operations	331	294	297,728
9. Auxiliary Services	67	273	39,880
10. Non-Institutional Organizations	153	271	70,171
TOTALS	14,474	142,508	7,160,502

* These square feet include all assignable square feet in each of these functional categories.

Table 16 provides a summary of the non-residential space by function for each of the six institutions, while Table 17 translates the total square footage into square feet per student enrolled in each of them. According to this table, each of the institutions, except for Ohio State, reports between 42 and 54 square feet of instructional space per student. Ohio State has an average of about 76 square feet. It also has by far the highest square feet per student for research. Its total square feet per student is also higher than any of the other institutions'. This situation, however, is understandable in view of the diversity and scope of the instructional and research programs at the university, and compares well with the "standards" now under consideration at California for the university.

Table 16.
Extent of Non-Residential Facilities by Function and Institution
(Assignable Square Feet)

INSTITUTION	FUNCTION										TOTAL
	Instruct.	Research	Library	Admin.	Public Service	Internal Services	Student Services	Plant Operat's.	Auxil. Service	Non-Inst. Organs.	
Bowling Green	343,212	2,180	25,481	8,089	30,335	31,286	23,644	9,593	1,804	1,740	477,364
Central State	98,226	168	19,938	3,395	19,633	12,945	50,561	22,233	14,163	6,059	247,321
Kent	470,828	23,981	65,890	46,820	1,119	22,129	61,737	34,408	496	.....	727,408
Miami	443,416	4,740	43,997	5,593	17,804	19,717	162,581	26,766	5,703	1,857	732,174
Ohio State	2,208,975	687,925	308,508	84,161	218,317	187,072	273,680	167,540	15,597	60,515	4,212,290
Ohio Univ.	484,026	317	36,797	35,443	18,400	54,412	95,195	37,188	2,117	.....	763,895
TOTAL	4,048,683	719,361	500,611	183,501	305,608	327,561	667,398	297,728	39,880	70,171	7,160,452

Table 17
SQUARE FEET PER STUDENT ENROLLED OF NON-RESIDENTIAL FACILITIES BY
FUNCTION AND INSTITUTION

INSTITUTION	FUNCTION										TOTAL
	Instruct.	Research	Library	Admin.	Public Service	Internal Services	Student Services	Plant Operat'ns.	Auxil. Service	Non-Inst. Organs.	
Bowling Green *7,504	45.74	.29	3.40	1.08	4.04	4.17	3.15	1.28	.24	.23	63.62
Central State *1,988	49.41	.08	10.03	1.71	9.88	6.51	25.43	11.18	7.12	3.05	124.40
Kent *10,990	42.84	2.18	5.99	4.26	.10	2.01	5.62	3.13	.05	.....	66.18
Miami *8,210	54.0	.58	5.36	.68	2.17	2.40	19.80	3.26	.69	.23	89.17
Ohio State *28,795	76.71	23.89	10.71	2.92	7.58	6.50	9.50	5.82	.54	2.10	146.27
Ohio Univ. *9,573	50.56	.03	3.84	3.70	1.92	5.68	9.94	3.88	.22	.....	79.77
Ave. No. of Sq. Ft. Per Total of Students Per Function *67,060	61.30	10.73	7.47	2.74	4.56	4.88	9.95	4.44	.59	1.05	107.71

*Enrollments, Fall 1962, On Campus.

Table 18
EXTENT OF NON-RESIDENTIAL FACILITIES BY TYPE AND INSTITUTION
(Assignable Square Feet)*

INSTITUTION	Lecture Room	Class-Room	Seminar Room	Teaching Lab	Offices	Office-Research-Lab	Research Lab	Research Lab-Office	TOTAL
Bowling Green	10,748	77,974	806	60,136	77,738	2,273	4,883	.....	234,558
Central State	1,120	28,398	.....	20,180	24,216	1,146	120	.....	75,180
Kent	13,142	82,320	3,688	64,390	62,081	3,075	10,464	2,218	241,378
Miami Univ.	19,347	78,492	8,398	72,168	96,336	4,413	6,679	3,567	289,400
Ohio State Univ.	81,537	204,553	14,002	335,361	910,851	16,949	12,870	15,381	1,591,504
Ohio Univ.	54,836	56,318	5,887	57,841	96,964	283	21,486	648	294,263
TOTAL	180,730	528,055	32,781	610,076	1,268,186	28,139	56,502	21,814	2,726,283

*Does not include related service areas. (See Tables 19, 20, 21, 22.)

Non-Residential Facilities by Type

The room-by-room inventory also provided data on non-residential facilities by type; that is, whether they were lecture rooms, classrooms, seminar rooms, teaching laboratories, offices, research laboratories, or library reading rooms. These data are shown in Table 18 in general summary form. Specific analyses of the data are presented in the tables that follow.

In Tables 19 through 23, the data on extent of usable square feet of space are summarized in the following categories: (1) classrooms, (2) teaching laboratories, (3) research facilities, (4) offices, and (5) libraries.

Classrooms

A summary of data on extent of classroom space is shown in Table 19. In addition to lecture rooms, general classrooms, and seminar rooms, the tabulation includes rooms labeled as "service" and used to supplement the main type of room.

The six institutions reported using 1,157 classrooms in which there were 57,700 student stations. The net usable square footage in these rooms was 856,883, for an average of 741 square feet per room, and an average of 14.85 square feet per student station. This was an average of 12.78 square feet per student enrolled.

These averages of space in classrooms are very similar to those found in a 1961 study of the nine state-supported institutions in Michigan, where the average per student station was 15.3 square feet and the average per student enrolled was 11.2 square feet. These figures are also very close to the suggested "standards" for the colleges and universities in California.

Table 20 is a summary of the net assignable square feet in teaching laboratories. The six state institutions reported a total of 477 teaching laboratories and 1,411 teaching laboratory service rooms in use in the fall of 1962. This was a total of 1,888 rooms. In all of these rooms there were 22,004 student stations and 1,233,293 square feet of usable space.

The average per student enrolled was 18.39 square feet and the average per student station was 56.05 square feet.

Two points should be emphasized. First, by virtue of their purposes, laboratories require considerably more spacious provisions than most regular classrooms. Second, there is such a wide variety in the instructional activities of the several subject areas that there results a wide variation in the space needed, say, for a laboratory in beginning biology as compared to one in advanced chemistry.

The averages shown in Table 20 compare very closely with the results of the Michigan study and the suggested California "standards."

Table 21 is a summary of the extent of space devoted to research activities. In the case of research space, the number of rooms and student stations is relatively unimportant. Importance, however, attaches to the total square feet of space. The six Ohio institutions reported a total of 397,669 square feet of space used for research activities.

Because of the complexity and diversity of the research enterprise, there are no readily available "bench marks" or standards regarding research space. In Table 21, the

Table 19
EXTENT OF INSTRUCTIONAL SPACE IN CLASSROOMS AT ALL
OF THE STATE INSTITUTIONS

ITEM	Lecture Room	Lecture Service	Class-room	Classroom Service	Seminar Room	Seminar Service	Total Classrooms	Total Service	TOTAL
Number of Rooms	133	23	711	170	68	52	912	245	1,157
Number of Student Stations	15,932	1,622	34,587	3,114	1,729	716	52,248	5,452	57,700
Sq. Ft. of Assignable Space	180,730	191,258	528,055	77,808	32,781	18,251	741,566	115,317	856,883
Ave. Size of Rooms (Sq. Ft.)	1,359	837	743	458	482	351	813	471	741
Sq. Ft. Per Student Enrolled*	2.70	.29	7.87	1.16	.49	.27	11.06	1.72	12.78
Sq. Ft. Per Student Station	11.34	.....	15.27	.....	19.0	.....	14.19	.....	14.85

*Enrollment for Fall 1962: 67,060 (On Campus)

space is related to the number of students enrolled and the number of graduate students enrolled. Perhaps the latter is more useful than the former due to the evident relationship of research to graduate programs.

The average number of square feet per student enrolled is 5.9 and the average per graduate student enrolled is 59.4 square feet. These averages can be compared with the Michigan institutions where the average was 7.7 square feet per student enrolled and 32.0 square feet per graduate student enrolled. The suggested "standard" for California is 13 square feet per student enrolled indicating the need for additional research space in the Ohio institutions.

Table 20
EXTENT OF INSTRUCTIONAL SPACE IN TEACHING LABORATORIES AT ALL
OF THE STATE INSTITUTIONS

ITEM	Teaching Laboratory	Teaching Lab Service	TOTAL Laboratory
Number of Rooms	477	1,411	1,888
Number of Student Stations	15,315	6,689	22,004
Square Feet of Assignable Space	610,076	623,217	1,233,293
Ave. Size of Rooms (sq. ft.)	1,279	442	653.23
Square Feet Per Student Enrolled*	9.10	9.29	18.39
Square Feet Per Student Station	39.84	.....	56.05

*Enrollment: 67,060 Fall, 1962 (On Campus)

Table 21
EXTENT OF RESEARCH SPACE AT ALL OF THE INSTITUTIONS

ITEM	TYPE OF RESEARCH FACILITY					TOTAL
	Office & Resch. Lab	Resch. Lab & Service	Animal Qtr. & Service	Greenhouse, etc.	Other Research	
No. of Rooms	207	410	95	27	187	926
Square Feet	64,242	86,621	29,973	54,107	162,726	397,669
No. of Stations	444	114	8	40	282	888
Sq. Ft. Per Station	145	759	3,745	1,353	577	447.8
Sq. Ft. Per Grad. Stud. Enrolled ¹ (1962)	9.6	12.9	4.5	8.1	24.3	59.4
Sq. Ft. Per Grad Deg. Granted in 1959-60 ²	34.5	45.6	16.1	29.1	87.5	213.8
Sq. Ft. Per Student Enrolled ³ (1962)	.96	1.3	.45	.81	2.4	5.9

¹Graduate Enrollment, Fall 1962: 6,696

²No. of Graduate Degrees Granted, 1959-60: 1,860

³Total Enrollment, Fall 1962: 67,060 (On Campus)

In its variety, office space is not unlike research space. Data on office space in five categories are summarized in Table 22. With proper emphasis on the teacher-student relationship in higher education, the faculty office becomes more than a place to store books and hang one's hat. Attention here is given particularly to the faculty office included under the heading of "Office" in Table 22.

It is interesting to note that there were 5,349 such rooms reported by the six institutions but there was a total of 11,950 desks, which would suggest an *average* of two occupants per office. Although many faculty members have private offices, these data and personal observations suggest that perhaps as many teaching staff share office space. Again, the point must be made that if the faculty office is to serve a major role in the educational effort of the faculty member, the private office space becomes essential.

The average of 18.92 square feet per student enrolled and 106.2 square feet per desk are well within averages found in other studies or recommendations.

Table 22
EXTENT OF OFFICE FACILITIES AT ALL OF THE INSTITUTIONS

ITEM	TYPE OF OFFICE FACILITIES					TOTAL
	Office	Office Service	Student Activity	Conference	Faculty Music Studio and Office	
No. of Rooms	5,349	758	57	165	75	6,404
Square Feet	1,268,714	127,290	70,549	52,445	20,829	1,539,827
No. of Stations or Desks	11,950	367	543	2,608	250	15,718
Capacity (In Stations)	11,868	635	783	2,656	248	16,190
Sq. Ft. Per Station or Desk	106.2	346.8	129.9	20.1	83.3	98.0
Sq. Ft. Per Student Enrolled*	18.92	1.90	1.05	.78	.31	22.96

*Enrollment for Fall 1962: 67,060 (On Campus)

Table 23
EXTENT OF LIBRARY SPACE AT ALL OF THE STATE INSTITUTIONS

ITEM	TYPE OF LIBRARY SPACE FACILITIES				TOTAL
	Study or Reading Room	Carrell	Stack Area	Service Area	
Number	167	169	117	62	515
Square Feet	200,065	6,491	222,804	29,299	458,659
No. of Student Stations	6,727	179	3,362	349	10,617
Sq. Ft. Per Student Enrolled*	2.98	.097	3.32	.44	6.84

*On-Campus Enrollment, Fall 1962: 67,060

As a learning facility, the library has always received considerable attention, but in current thinking about learning resources and the student's individual role in learning, the library takes on an even more important function. This new emphasis requires not only that many books be stored, but that they be readily identified and available to the student and that sufficient space be provided for students in the library itself.

According to Table 23, in the six Ohio institutions there is a total of 458,659 square feet of usable library space. Of this, 200,065 square feet are in reading rooms and 222,804 square feet are in stack areas. There is seating for a total of 10,617 students, or just 15.8 percent of the total enrollment in 1962. In order to seat 25 percent of the present student body, the institutions would need about 6,000 *additional* student stations in their libraries.

Resume and Implications

1. In the six institutions of higher education in Ohio
 - a. there is a total of 11,284,682 square feet of non-residential space;
 - b. these non-residential facilities have a plant-ledger value of \$163,408,000;
 - c. of the total value, 80 percent was derived from direct state appropriated funds.
2. In the six institutions, a total of 984,019 square feet of space (about 8.7 percent) was reported as "should be razed and/or replaced."
3. Since 1950, the extent of facilities has increased by 58 percent, while enrollments have increased by 100 percent.
4. Of 7,160,502 net square feet of space reported, 72 percent was classified under instruction, research, library, and administration.
5. For all six institutions, there is an average of 107.71 square feet per student enrolled, with a variation of 63.62 square feet at Bowling Green to 146.27 square feet at Ohio State University.
6. In the six institutions as a group,
 - a. space for classrooms averages 12.78 square feet per student enrolled and 14.58 square feet per student station, averages which are very similar to those reported for Michigan and California;
 - b. space for teaching laboratories averages 18.39 square feet per student enrolled and 56.05 square feet per student station.
7. Additional research space needs to be provided at the appropriate institutions. The average per student enrolled was 5.9 square feet as compared to 7.7 square feet in Michigan and the 13 square feet recommended in California for its university.
8. As additional office space is provided, particular attention needs to be given to the faculty office, especially regarding the matter of privacy.
9. Additional library space is needed for present enrollments as well as for the anticipated increases in the future. For example, to provide seating for at least 25 percent of the student body in 1962, the institutions need 6,000 *additional* student stations in their present libraries.

UTILIZATION OF INSTRUCTIONAL FACILITIES

In the study of the utilization of instructional facilities and the possible dollar savings that might be achieved as a result of improved levels of use, several factors must be given recognition:

1. Instructional space comprises only a part of the total institutional space required for students and faculty on any given campus. Usually this is less than 40 or 50 percent. Thus, a given percentage increase in the use of instructional facilities may not reflect itself in as large a dollar saving as might be expected.
2. Emphasis must be placed on the integral relationship between the existing instructional program and the level of utilization attainable. The point is that the improvement of space utilization is not an end in itself, but derives from optimal management of the instructional program and its scheduling.
3. In practically every case where institutions have analyzed the utilization of their instructional space, the findings have clearly indicated that improvements are possible and that these improvements have implications for substantial dollar savings.

As part of this study, a detailed analysis was made of the utilization of instructional facilities in the six state institutions. This analysis focused on facilities classified as "classrooms" and "teaching laboratories." The extent of space involved here was about two million square feet of net assignable space, or approximately three million square feet of gross space. Thus, the analysis included about 35 percent of the total non-residential facilities.

Size of Room and Size of Class

A very useful and general indicator of classroom and teaching laboratory utilization is a summary relating the capacity of the rooms with the size of the classes meeting in them. Table 24 summarizes these data for the classrooms and teaching laboratories in the six Ohio institutions. In this table, the size of class is shown across the top and the capacity of the rooms is shown in the left-hand, vertical column.

The table is interpreted as follows. For example, under the size of class heading in the range 20-29, there were 1,865 such classes which met in rooms which had a capacity of 20-29. At the same time, there were 2,251 classes with enrollments between 20-29 which met in rooms with capacities of 30-39. And, furthermore, there were 2,195 classes enrolling between 20-29 students which met in rooms having a capacity of 40-49. The heavy diagonal rectangles enclose the number of class meetings in which the size of class and the size of room intervals were equal.

More specifically, the entries below and to the left of the diagonal are those in which the size of class was *smaller* than the capacity of the room. (Here the capacity refers to the "rated capacity.") According to this table, there is an unusually high number of instances where the size of the class is considerably below the room capacity.

Table 24
DISTRIBUTION OF ROOM-PERIODS OF USE PER WEEK ACCORDING TO THE STUDENT STATION CAPACITY
OF ALL ROOMS AND THE SIZE OF CLASSES MEETING IN THEM: FOR ALL OF THE STATE INSTITUTIONS

Room Capacity	SIZE OF CLASS											PER CENT
	1 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 to 79	80 to 89	90 & Above	TOTAL	
1 to 9	168	59	27	16	.....	.....	...	...	...	.....	270	.8
10 to 19	856	911	234	82	36	.....	...	...	...	.....	2,119	6.6
20 to 29	1,055	1,579	1,865	202	111	6	5	...	...	.....	4,823	15.0
30 to 39	584	1,125	2,251	1,560	59	19	4	32	...	.....	5,634	17.6
40 to 49	312	1,007	2,195	2,151	665	67	11	19	...	.....	6,427	20.0
50 to 59	225	603	1,363	1,152	891	395	31	14	...	.....	4,674	14.5
60 to 69	143	267	765	621	562	320	142	28	...	.....	2,848	8.8
70 to 79	41	168	288	302	237	154	100	112	12	3	1,417	4.4
80 to 89	42	133	299	182	182	88	54	64	93	4	1,141	3.5
90 & Above	95	187	248	378	187	280	225	233	217	787	2,837	8.8
Total Class Meetings Per Week	3,521	6,039	9,535	6,645	2,930	1,329	572	502	322	794	32,190	100.0
Percentage	10.9	18.8	29.6	20.6	9.1	4.1	1.8	1.6	1.0	2.5	100.0	100.0
Cumulative Percentage	10.9	29.7	59.3	79.9	89.0	93.1	94.9	96.5	97.5	100.0	100.0	.....

This lack of fit, of course, may be the result of (1) poor scheduling procedures, (2) inappropriate room sizes, and/or (3) too many small classes which could be increased in size. There is no doubt that the first two factors operate in most colleges and universities. In the case of the Ohio institutions in this study, the possibility of "too many small classes" is suggested by the horizontal entry headed "total class meetings per week." According to this, 10.9 percent of all the classes in the six institutions enrolled less than 10 students and 29.7 percent of the classes enrolled less than 20 students. At the same time, only 11 percent of the classes enrolled 50 or more students.

Room-Period Utilization

There exist several measures of utilization. One of these is the number of room periods of use per week. Thus, a room may be scheduled for 23 class meetings in a given week. Regardless of the size of class meetings in this room, this room is said to have 23 room periods of use per week.

For purposes of comparison, the number of room periods of use is then translated into the percentage of possible room periods of use for a week consisting of an arbitrarily set number of hours. For this study, the base selected was a 44-hour week. Thus, an average of 23 room periods of use per week per room would become $23/44$ times 100 as the percentage of possible room period utilization for that room. This would be 52.3 percent.

Of particular importance is the percentage of possible room-period utilization by days of the week and hours of the day. Table 25 summarizes data on room-period utilization for classrooms in the six institutions as a group.

The percentage of possible room period utilization by days of the week is shown in the last horizontal entry. Thus, on Wednesday there was 66.7 percent of the possible room-period utilization on the basis of a 44-hour week. It is rather evident that the utilization of classrooms in the six institutions is not entirely even among the days of the week. The percentages would suggest that these institutions still retain some of the traditional scheduling which has lectures on Monday, Wednesday, and Friday and the laboratories on Tuesday and Thursday. The table also suggests that the Saturday morning hours are not too frequently utilized as yet.

Room-period utilization by hours of the day is summarized by the percentages in the column on the far right. This column of data clearly points up the uneven distribution of classes during the regular day. At eight o'clock in the morning, there is 50.9 percent possible room-period utilization, and during the noon hour the utilization drops to 29.3 percent. The two late afternoon hours (3:00 and 4:00 p.m.) also show a sharp decrease in use.

Table 25
Classrooms: Room-Period Utilization by Day of the Week and Hour of the Day —
All Institutions
(Total Room Periods of Use)

Hour	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total	Percentage of Possible Room Periods of Use (5½ day week)
8-9	543	414	545	425	538	82	2,552	50.9
9-10	645	551	642	541	662	143	3,184	63.5
10-11	665	555	643	563	630	131	3,192	63.6
11-12	665	442	651	501	585	94	2,918	58.2
12-1	232	229	286	216	295	26	1,334	29.3
1-2	603	524	620	520	593	24	2,889	63.4
2-3	602	484	614	485	554	25	2,764	60.6
3-4	419	352	408	342	343	23	1,892	41.5
4-5	166	144	182	168	129	21	810	17.8
5 and After	296	298	274	263	55	110	1,296	28.4
TOTAL	4,896	3,973	4,870	4,024	4,389	679	22,831	....
Percentage of Possible Room Period Use (8 Hour Day)	67.1	54.5	66.7	55.2	60.2	18.5	....	....

For the teaching laboratories, room-period utilization is summarized in Table 26. As in the case of the classrooms, the percentage of utilization is uneven by days of the week and hours of the day. The maximums occur on Tuesday and Thursday and at 2:00 and 3:00 p.m. Although the time required for laboratory experiment set-ups presents special problems, it is quite evident that more careful scheduling of laboratories should result in space for additional students.

Table 26
Teaching Laboratories: Room-Period Utilization by Day of the Week and Hour of the Day
ALL STATE INSTITUTIONS
(Total Room Periods of Use)

Hour	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Total	Percentage of Possible Room Periods of Use (5½ day week)
8-9	177	178	171	174	159	28	887	33.8
9-10	224	254	225	232	210	53	1,198	45.7
10-11	225	251	227	257	177	54	1,191	45.4
11-12	189	211	199	223	168	41	1,031	39.3
12-1	63	63	61	59	56	17	319	13.4
1-2	218	218	211	220	186	17	1,070	44.9
2-3	271	270	275	269	231	17	1,333	55.9
3-4	228	244	240	248	183	17	1,160	43.6
4-5	144	156	152	161	132	17	762	31.9
5 and After	76	104	58	91	22	93	444	18.6
TOTAL	1,815	1,949	1,819	1,934	1,524	354	9,395	....
Percentage of Possible Room Period Use (8 Hour Day)	47.6	51.1	47.7	50.7	39.9	18.6	....	....

Percentages of possible room-period utilization of classrooms and laboratories for each of the six institutions are summarized in Table 27. For all types of classrooms, the six institutions have an average of 56.8 percent room-period utilization. The variation is from a low of 46.0 percent at Central State College to a high of 69.0 percent at Kent State University.

For teaching laboratories, the six institutions have an average of 46.6 percent of possible room-period utilization with a variation from a low of 24.5 at Central State College to a high of 60.3 at Kent State University.

Table 27.
Percentage of Possible Room-Period Utilization
for Classrooms and Laboratories: 44-Hour Week
(By Institution)

INSTITUTION	CLASSROOMS				LABORATORIES	TOTAL ALL ROOMS
	General	Special Lectures	Seminars	Total Classrooms		
Bowling Green	51.3	44.3	15.9	50.6	44.5	48.3
Central State	44.7	100.0	....	46.0	24.5	40.6
Kent State	72.9	79.2	18.4	69.0	60.3	66.1
Miami Univ.	49.1	62.5	34.4	48.9	38.7	46.0
Ohio State	66.4	46.1	23.8	59.7	47.1	54.5
Ohio Univ.	54.4	56.3	42.1	54.2	43.1	51.4
TOTAL	60.0	54.3	28.0	56.8	46.6	53.3

These percentages may have more meaning if they are compared with other institutions in which utilization studies have been made. In general, the six institutions show up relatively well in the table of norms prepared by Russell and Doi. In comparison to a group of 90 institutions, the 56.8 percentage of possible utilization of classrooms places the six institutions above the 70th percentile. Even the lowest Ohio percentage at Central State College falls at the 50th percentile.

For teaching laboratories, the average of 46.6 percent for the six institutions falls at the 70th percentile, while the 24.5 percent for Central State College places it at about the 20th percentile. The high of 60.3 percent of Kent places it above the 90th percentile.

Another useful reference on utilization levels is the set of recommendations adopted in 1960 as part of the Master Plan for Higher Education in California. In this document, the recommendation is made that "the standard of utilization of classrooms be at the maximum practicable levels, but in no case shall average less than 30 scheduled hours per week." For the teaching laboratories, the same recommendation suggests "no less than an average of 20 scheduled hours per week." On the basis of a 44-hour week, the former would be about 68 percent utilization and the latter about 45 percent. In the six Ohio state institutions, the percentage for classrooms was 56.8 percent and for laboratories it was 46.6 percent.

A general summary of data regarding classrooms and laboratories is presented in Table 28. This table also presents utilization percentages for the nine Michigan institutions of higher education for 1961. In addition to summarizing room-period utilization data for the Ohio institutions, this table presents data on student-station utilization. According to the data, the average student station at these institutions is occupied 14.8 hours per week. This is 33.6 percent of the possible use on the basis of a 44-hour week.

Table 28.
Summary of the Utilization of Instructional Space In Classrooms and Laboratories.
(All of the State Institutions)

ITEM	CLASSROOMS				Lab- oratories	Total For All Rooms	NINE MICHIGAN INSTITUTIONS (1961)
	General	Special Lecture	Seminars	Total For Classrooms			
Number of Rooms	711	133	68	912	477	1,389	2,088
Total Room Periods Used	18,772	3,175	839	22,786	9,782	32,568	108,757
Ave. No. of Room Periods of Use Per Room Per Week	26.4	23.9	12.3	25.0	20.5	23.4	26.0
Percent of Possible Room Periods of Use In a 44-Hour Week	60.0	54.3	28.0	56.8	46.6	53.2	59.1
Number of Student Stations	34,587	15,932	1,729	52,248	15,315	67,563	92,585
Student Station Periods of Occupancy	553,062	203,189	14,136	770,389	226,775	997,164	2,653,825
Percent of Student Station Use When Room Is In Use	59.3	51.3	57.5	56.9	64.7	58.5	56.3
Ave. Stud. Sta. Period of Occupancy Per Stud. Sta. Per Week	16.0	12.6	8.2	14.7	14.8	14.8	14.2
Percent of Possible Stud. Sta. Period Use In a 44-Hour Week	36.4	28.6	18.6	33.4	33.6	33.6	32.4
Ave. Stud. Sta. Periods of Occupancy Per Student Enrolled	3.0	8.2	0.2	11.5	3.4	14.9	14.1

When the rooms are actually in use, 58.5 percent of the student stations are occupied. For teaching laboratories this is 64.7 percent and for classrooms it is 56.9 percent. What this statistic means is that when the typical room is being used by classes, on the average just over half of the seats are occupied. Again, this problem is related to scheduling procedures, appropriate sizes of rooms, and a possible large number of small classes as was suggested in the discussion of Table 24.

Resume and Implications . . .

1. The six Ohio state institutions should give more careful attention to systematic scheduling relating size of class and capacity of room in which it meets.
2. Perhaps more importantly, attention should be given to the relatively large number of small classes, the data indicating that 29.7 percent of the class sessions were with enrollments of less than 20 students.
3. As new buildings are constructed, careful attention should be given to the distribution of room capacities in these buildings. That is, room-capacity distributions should fit more closely the existing and future class sizes.
4. The institutions should strive for a more even distribution of room-period utilization by days of the week and hours of the day. This would permit serving more students in the present instructional space.
5. Evening and Saturday morning hours represent a possible source of classroom capacity which can be tapped when it becomes necessary and feasible.
6. Also, similar attention should be given to the relatively low utilization of the noon hour and the two late-afternoon class hours.
7. In general, utilization of instructional facilities by the six Ohio institutions compares well with utilization in the nine Michigan institutions and the suggested California utilization standards, but clearly improvements are possible.

SUMMARY OF THE FACILITIES AND CAPITAL NEEDS

This final section of the report, based on the data of the preceding sections, summarizes in tabular form the extent of the facilities needs in the six Ohio institutions of higher education between 1962 and 1972. Table 29 presents data on the following:

Line 1 — Total enrollment projections in the six institutions for each biennium.

Line 2 — Total enrollment projections on the several campuses of the institutions, assuming that the Dayton Center will be a campus by 1972.

Line 3 — The percentage that the on-campus enrollment is of the total.

Line 4 — The number of student credit hours which will have to be taught for the enrollment projections.

Line 5 — The number of student credit hours per student per term that is assumed to be the case for the future.

Line 6 — The total number of student clock hours, or actual classroom attendance implied by these student credit hours. The assumption is that the average will be about 16 per student.

Line 7 — Data on classrooms, including the number of student clock hours, the assumed number of square feet per student clock hour, the net and gross square feet, and the cost at an average of \$20 per square foot. In the case of classrooms, the number of square feet per student clock hour is assumed to *decrease* from 1.1 in 1962 to .80 in 1972 implying a substantial improvement in the utilization levels for classrooms.

Line 8 — Data on laboratories. Entries here include the number of student clock hours projected for laboratory instruction, the average number of square feet per student clock hour, the net and gross square footage, and the cost at an average of \$32 per square foot. In the case of laboratories, the average number of square feet per student clock hour is assumed to decrease from 4.6 in 1962 to 3.0 by 1972, again assuming a substantial increase in the intensity of utilization of the teaching laboratories.

Line 9 — This is space which is needed to supplement the classrooms and teaching laboratories in instruction. The assumption is that the ratio of such supplemental space to the classroom and laboratory space will remain the same throughout the decade.

Line 10 — Data on library facilities needs. For the reasons cited in the section on library space, the number of square feet of library space per student enrolled is being increased from 6.8 in 1962 to 9.0 in 1972. The resulting total square footage should provide enough additional space for books as well as for student reading space.

Line 11 — The provision of office space, in square feet per student enrolled, is assumed to decrease from 18.9 to 15.0 by 1972.

Line 12 — In the discussion of research space in a preceding section, the need for additional facilities was indicated. In these calculations it is assumed that the amount of research space will be tripled by 1972.

Line 13 — Replacement needs over the decade are shown in this line.

Line 14 — The total net square feet of space in existence each biennium.

Line 15 — The total gross square feet of space in existence each biennium.

Line 16 — The total new net square feet of space accumulating over the year 1962.

Line 17 — The total new gross square feet of space over 1962.

Line 18 — The total cost for each biennium between 1964 and 1972. This was obtained by summing the total estimated costs for each type of facility as computed under the respective headings.

Resume

It should be observed that the enrollment projection envisions more than a doubling of enrollments by 1972. At the same time, the assumed improved level of utilization of classrooms and teaching laboratories will provide for this increase with only a 57 percent increase in the net square footage for classrooms and an increase of 37 percent in the net square footage for teaching laboratories. Thus, instead of having to provide approximately \$166,000,000 in classrooms and laboratory space by 1972, this study suggests that the needs can be met with an outlay for these types of facilities for about \$120,000,000.

The total *new gross square footage* which is projected for the Ohio institutions is 9,662,028 which would *cost approximately 217 million dollars*. The cost per each biennium between 1962 and 1972 suggests that the capital needs will vary, diminishing considerably after the needs for 1968 have been met.

Finally, the needs for facilities at the six state institutions of higher education have been presented under seven different headings. Sufficient detail is projected with each of the seven categories so that the Ohio Legislature in consultation with the six institutions will be able to make commitment decisions either for all of the implied needs or such specific portions as can be financed at any given time. The urgent recommendation is, of course, that if Ohio is to provide for the numbers of students who will be seeking education beyond the high school in that state, major capital outlay commitments must be made now.

Table 29. SUMMARY OF CALCULATED INSTRUCTIONAL FACILITIES NEEDS FOR THE SIX STATE-SUPPORTED INSTITUTIONS OF HIGHER EDUCATION IN OHIO: 1962 - 1972

	1962	1964	1966	1968	1970	1972
				Cumulative		
1. Enrollment (total head-count)	80,583	90,474	111,694	138,332	147,869	161,650
2. Enrollment (on campus head-count)	67,060	75,998	94,381	117,582	126,427	140,473
3. Campus as Percent of Total(*)	83.2	84.0	84.5	85.0	85.5	86.9
4. Student Cr. Hrs. (On Campus)	963,997	1,139,970	1,415,715	1,763,730	1,896,405	2,107,095
5. Student Cr. Hrs./Stu./Term	14.4	15.0	15.0	15.0	15.0	15.0
6. Total Student Clock Hrs. (a)	1,072,960	1,215,968	1,510,096	1,881,312	2,022,932	2,247,568
7. Classroom—1. Stu. Cl. Hrs. (b)	804,720	911,976	1,132,572	1,410,984	1,517,124	1,685,676
2. Sq. Ft./Stu. Cl. Hr. (1)	1.1	1.0(3)	.90	.85	.80	.80
3. Total Net Sq. Ft.	856,883	911,976	1,019,314	1,199,336	1,213,699	1,348,540
4. Total Gross Sq. Ft. (6)	1,278,929	1,361,151	1,521,356	1,790,044	1,811,482	2,012,736
5. Cost @ \$20/Sq. Ft.**	\$25,578,580	\$27,223,020	\$30,427,120	\$35,800,880	\$36,229,640	\$40,254,720
8. Laboratory—1. Stu. Cl. Hrs. (c)	268,240	303,992	377,524	470,328	505,708	561,892
2. Sq. Ft./Stu. Cl. Hr.	4.6	4.4(4)	4.0	3.5	3.3	3.0
3. Total Net Sq. Ft.	1,233,293	1,337,564	1,510,096	1,646,148	1,668,836	1,685,676
4. Total Gross Sq. Ft.	1,840,735	1,996,354	2,253,863	2,456,925	2,490,787	2,515,922
5. Cost @ \$32/Sq. Ft.	\$58,903,520	\$63,883,328	\$72,123,616	\$78,621,600	\$79,705,184	\$80,509,504
9. Other Instructional						
1. Total Net Sq. Ft. (8)	1,236,938	1,652,220	2,067,300	2,482,380	2,897,450	3,312,540
2. Total Gross Sq. Ft.	1,845,511	2,465,112	3,084,411	3,703,710	4,323,010	4,942,309
3. Cost @ \$15/Sq. Ft.	\$27,682,665	\$36,976,680	\$46,266,165	\$55,555,650	\$64,845,150	\$74,134,635
10. Library—1. Sq. Ft./Stu. (7)	6.8	7.8	8.8	9.0	9.0	9.0
2. Total Net Sq. Ft.	458,659	592,784	830,552	1,058,238	1,137,843	1,264,257
3. Total Gross Sq. Ft.	684,565	884,747	1,239,623	1,579,451	1,698,264	1,886,941
4. Cost @ \$24/Sq. Ft.	\$16,429,560	\$21,233,928	\$29,750,952	\$37,905,824	\$40,758,336	\$45,286,584
11. Office—1. Sq. Ft./Stu.	18.9	18.0	17.0	16.0	15.0	15.0
2. Total Net Sq. Ft.	1,268,714	1,367,964	1,604,477	1,881,312	1,896,405	2,107,095
3. Total Gross Sq. Ft.	1,893,602	2,041,727	2,394,730	2,807,914	2,830,441	3,144,902
4. Cost @ \$24/Sq. Ft.	\$45,446,448	\$49,001,443	\$57,473,520	\$67,389,936	\$67,930,584	\$75,477,648
12. Research—1. Total Net Sq. Ft. (5)	397,669	597,669	897,669	1,047,669	1,097,669	1,193,000
2. Total Gross Sq. Ft.	593,535	892,038	1,339,797	1,563,677	1,638,303	1,780,588
3. Cost @ \$32/Sq. Ft.	\$18,993,120	\$28,545,216	\$42,873,504	\$50,037,664	\$52,425,696	\$56,978,816
13. Replacement						
1. Total Net Sq. Ft. (2)	.....	203,079	405,158	609,237	812,316	1,015,395
2. Total Gross Sq. Ft.	.....	303,101	605,202	909,304	1,212,405	1,515,507
3. Cost @ \$25/Sq. Ft.	.....	\$ 7,577,525	\$15,155,050	\$22,732,600	\$30,310,125	\$37,887,675
14. TOTAL NET SQUARE FEET	5,452,156	6,663,256	8,335,566	9,924,320	10,724,228	11,926,503
15. TOTAL GROSS SQUARE FEET	8,136,877	9,944,230	12,439,982	14,811,025	16,004,692	17,798,905
16. TOTAL NEW NET SQ. FT. (over 1962)	.....	1,211,100	2,883,410	4,472,164	5,272,072	6,474,347
17. TOTAL NEW GROSS SQ. FT. (over 1962)	.....	1,807,353	4,303,105	6,674,148	7,867,815	9,662,028
18. COST PER BIENNIIUM	.....	\$41,407,252	\$59,628,782	\$53,975,227	\$24,159,561	\$38,324,543
				TOTAL COST—\$217,495,365		

(a) Based on 16 clock hours per student.
 (b) Based on 12 clock hours per student in classrooms.
 (c) Based on 4 clock hours per student in laboratories.
 (1) Square footage includes related service area.
 (*) Assumes growth of Dayton unit as a campus to 10,000 by 1972.
 (**) Based on an average cost in terms of today's dollar; includes construction, architect's fees, site development, furnishings, but not land acquisition.
 (2) Replacement is 7% of 1962 net, plus 758,000 square feet of space reported in 1962 as needing replacement. This is spread equally over 1964-1972. Total is 758,000 + 257,397 = 1,015,397, (exclusive of "other instruction").
 (3) Assumes improved level of utilization to .80 by 1972.
 Square Feet = $\frac{(S.C.H.) (20)}{72} = (S.C.H.) (.80)$
 (4) Assumes improved level of utilization to 3.0 by 1972.
 Square Feet = $\frac{(S.C.H.) (60)}{72} = (S.C.H.) (3.0)$
 (5) Increase research space by three times over 1962.
 (6) Assumes that net = 67% of gross.
 (7) Expansion of library space to provide for larger seating capacity.
 (8) Assumes that 1972 net in this category will be in the same ratio to total net in classrooms, laboratories, libraries, and offices as it was in 1962 (.324). This additional net of 2,075,404 is spread equally between 1964-72 at the rate of 415,080 sq. ft. per biennium.